MEASUREMENT OF
THE HUMAN FOOT

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WITH ILLUSTRATIONS.

THIRD EDITION.

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NORTHAMPTON

TECHNOLOGICAL HANDBOOKS.

EDITED BY

BEEBY THOMPSON, F.C.S., F.G.S.,

Late Director of the Science, Art, and Technical Schools, Northampton.

No. 1.

MEASUREMENT OF THE HUMAN FOOT

AND

LAST FITTING.

BY

WALTER J. LEWIS.

With Illustrations.

THIRD EDITION.

THE ILLUSTRATIONS FROM DRAWINGS BY

EDWARD J. C. KNIGHT,

First Honours Medallist in Boot and Shoe Manufacture, 1889.

LONDON:

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PREFACE.

The primary object of this series of Handbooks is to provide Students of Technological Classes, in the subject of Boot and Shoe Manufacture, with reliable information on the matters taught in those classes, so that the demonstrations given at the lectures may be followed with more ease than when notes must be made, and the after time of both students and teachers saved, the former in writing out an account of the lessons, and the latter in looking them over. Every care will be taken to give the best information on each subject, and when there can be no doubt as to the best method of doing a thing a description of that only may be given, but where reasonable differences of opinion exist, justice will be done to each, as far as possible. Whilst fully recognizing the value of work done by previous writers on the same subjects, it is believed that these handbooks will supply a want, both in the manner of publication, and the matter contained in them.

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MEASUREMENT OF THE HUMAN FOOT

AND

LAST FITTING.

Importance of the subject. There seems to be an ever growing demand on manufacturers for what are known to the trade as "*measures*" or "*specials.*" Several reasons might be assigned for this, besides the fastidiousness of customers, but with these reasons we are not concerned. Assume that purchasers will patronize the shop where they can be best suited, and that retailers will place their orders for stock goods with the manufacturers who pay most attention to their *specials* or *bespoke work*, and we have at once sufficient evidence of the importance of accurate measurement of feet by the one, and intelligent fitting up of lasts by the other.

It will be taken for granted that readers of this pamphlet have some knowledge of the mechanism and functions of the foot, such as the structure and use of the arch, the position and character of the pillars which support it, and the changes which take place in the act of walking; how, for instance, the arch is flattened, the toes shot forward, and the metatarsal bones spread out in each foot as the weight of the body is brought upon it. All these things must be *understood* in order that the allowances for extension and expansion may be intelligently carried out. The mere knowledge that certain allowances have to be made, without an idea why, is not creditable to any workman, and with the growth of Technological Instruction the time is fast approaching when it will not be justifiable.

Measuring Apparatus.

The only tools commonly used in the operation of measuring a foot are:

1. A sizestick.
2. A tape measure giving inches and divisions, or even a piece of paper of similar shape.
3. A lead pencil.
4. A plain sheet of paper rather larger than the foot.

The Sizestick, in its simplest form, consists of a graduated rectangular piece of boxwood, 18 inches in length, with a fixed upright perpendicular to it at one end, and a similar sliding upright *(see figures 1 and 2)*. Sizesticks are sometimes jointed, but we do not advise their use, as they frequently give way at the joints, especially after much use.

By the side of this letterpress will be found a reduced copy of the scale on an English sizestick showing sizes and half sizes. It will be seen that the starting point of the scale is quite arbitrary, and that a second start is made at about the centre of the scale. It is scarcely possible to justify the peculiar division adopted, but I suppose, now, it would be extremely difficult to alter it.

The various sizes of boots are classified as shewn below:—

Infants'	...	...	1s — 6s
Boys' and Girls'		...	7s — 1s
Youths'	...	...	2s — 5s
Women's	...	...	1s — 8s
Men's	...	...	5s — 12s

The necessity for all sizesticks being correct is very obvious. It very seldom happens that the same stick is used both for measuring the foot and the last, and if they vary (unfortunately they sometimes do), a correct fit cannot be relied upon. A correct sizestick should measure as follows :—

1s size 4⅓in., 3s size 5in., 6s size 6in., 9s size 7in., 12s size 8in.,

2s size 9in., 5s size 10in., 8s size 11in., 11s size 12in.

It will be seen from the above that there are 3 sizes to the inch, and the measures may be taken as representing the only scale recognised in Northampton.

Diagrams 1 and 2 represent two very useful forms of sizestick made by Mr. Duckenfield, of Northampton. *Fig. 1* represents a stick that can also be used for "*ranging*;" it has a set screw in the sliding head by means of which, as soon as the correct length of the foot has been taken, the head can be fixed, so that no shifting can occur as it is removed.

The one represented in *fig. 2* is similar to the last, but has, in addition, an arrangement for taking the height the boots are wanted up the back seam. A recent addition to both forms is a brass strip along the stick with French and English sizes marked on it. This strip is intended to prevent any alteration of length by shrinkage.

Another very useful addition to the sizestick has been made by Mr. Duckenfield, in the shape of a slide and arm on the movable upright. The slide moves in a vertical slot in the face of the movable upright and carries a small arm which, when in use, projects perpendicularly from it, the height of this projecting arm above the stick itself being shewn by a scale at the side of the slot. The particular use of this appliance is to measure, when required, the thickness of the toes, so that proper provision may be made by the last fitter in the case of ingrowing toe nails, raised toes, &c.

Fig. 1.

Fig. 2.

Tape-measure. Just one word of caution is necessary in regard to tape measures; test them first of all with a standard measure—a good sizestick will do—and even if correct frequently test them afterwards, as they are apt to stretch with use. The stretching is no doubt largely prevented by the practice of coiling thin copper foil on some of the threads, and weaving these longitudinally into the tape to the extent of about one-quarter the entire number of threads, i.e. about eight to the ordinary tape having a width of $\frac{5}{8}$ of an inch.

Method of Measurement.

The common method of measuring the foot is as follows :—The person is seated, with the foot raised from the ground, the fixed end of the sizestick is brought to the back of the heel, and the movable upright is brought up to just touch the most forward toe; the stick is then removed and the length in sizes noted. All other ordinary measurements are taken with the tape measure, and it is best, when taking the girth measurements, to have the leg thrown slightly forward, with the heel resting on the ground, as the foot can be held steady in that position without strain on any part. (*See fig. 3*). It may be advisable to place the foot in a different position for taking the heel measurement, as will be explained later on.

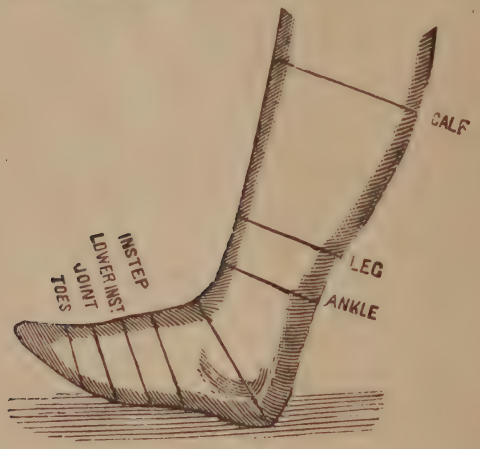

Fig. 3.

All measurements should be taken in a definite order, and entered, together with any other particulars, in a book, or on sheets specially ruled for the purpose. (*See page 16*).

For the positions of the various measurements see *figs. 3 and 4*.

The Joint measure is taken round the foot over the joints of the great and little toe.

Instep :—From the centre of the arch of the waist over the highest part of the instep.

Heel :—From the extreme backward point of the heel up round the throat of the foot or bottom of the leg.

Ankle :—A little above the ankle bone, round the smallest part of the leg. The exact position of this measurement may be noted when taking the height.

Height :—Carry the tape straight up the side of the leg, over the ankle bone, to the height required. This measure is sometimes taken up behind.

Leg :—Circumference of the leg exactly at the height required.

These measurements are the only ones usually required for Bals., or Button Boots, but for all kinds of long work it is necessary to take the *calf measure, &c*, but *not the ankle*, as such boots must be made large enough at the latter point for the heel to pass.

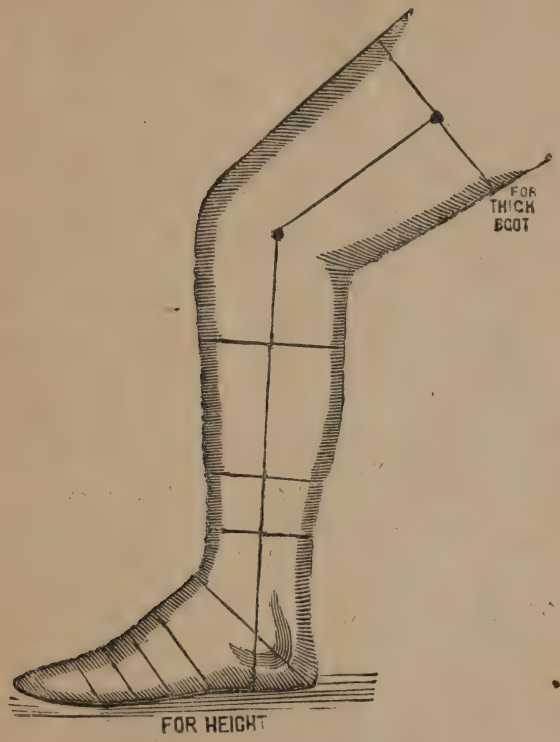

Fig. 4.

Additional measurements are sometimes made over the toes, and between the joint and instep, and may be described as *toes*, and *lower instep* respectively (*See fig. 3*), but these are not necessary unless there is some malformation of the foot.‡

‡ The Americans adopt a different plan, for instance, instead of a lower instep measure they take what is called a waist measure diagonally across the foot, from the top of the joint measure about the middle of the top of the foot to the waist; also a measure from the top of the instep round the heel, the same as the *heel measure of last*, by which description indeed it is known.

Draft of Foot. Having taken the length and girth measurements, the foot should be placed on a sheet of paper and an outline of it made with a lead pencil. The pencil must be held vertically, and carried quite close round the foot;* the inner side should be gone over a second time with the pencil tilted so as to go under the arch because the outline first obtained may give a very false idea of the sole shape, at this part, through abnormal projections on the inner side of the foot. On this draft of the foot should be marked the positions of *corns, bunions, &c.* (*See fig. 5*).

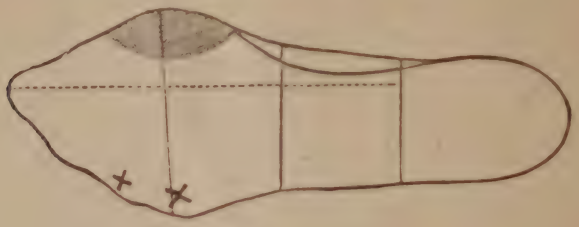

Fig. 5.

The draft of the foot is very valuable to a last fitter because it gives him information that the measures alone do not:—for instance, it gives *the shape of the sole*, and so helps him to identify the type of foot; it also shows the actual and relative *positions of the great and little toe joints*, and therefore the inclination to be given to the tape when making up the joint measure on the last.

Profile of Foot. Some Bespoke makers take a profile of the foot and leg when taking the draft. For this purpose a sheet of stiff cartridge paper is doubled, and the two halves made to stand at right angles to each other. The foot is placed upon one part, and a draft taken, and on the other part an outline of the shape of the leg and upper part of the foot is drawn by means of a long lead pencil, which latter must be kept quite horizontal whilst passing over the various parts of the leg or foot and marking the paper. By this method a plan and elevation of the foot is obtained. There is really little difficulty in taking the profile if a stiff piece of cardboard, bent as required, is always kept ready for placing the cartridge paper upon and against.

Position of Measurements. The position of the tape under the foot when taking a girth measurement is shown sufficiently well by the draft; the position of the tape over the foot may be determined as follows:—Carry the tape over the top of the foot from the tip of the most forward toe to the points where the tape previously crossed, and record such measurement in

* A pencil made flat on one side, by splitting or otherwise, could be made to give a more accurate outline, as the half thickness of the pencil need not then be added on all round.

inches, preferably on the chart itself, where the dotted longitudinal line crosses the transverse lines. (*See fig. 5*). In the diagram just referred to the transverse lines are supposed to be drawn vertically under where the tape crosses the top of the foot for the joint, instep, and heel measures respectively, but this is not necessary, except when extreme accuracy is required, only the *figures* at the crossings would usually be considered.

Location Tape. A very useful appliance for carrying out this system of locating the girth measures is the so-called "*location*" or "*triangular tape.*" It consists of two tapes at right angles to each other, each graduated from the angle where they meet. (*See fig. 6*).

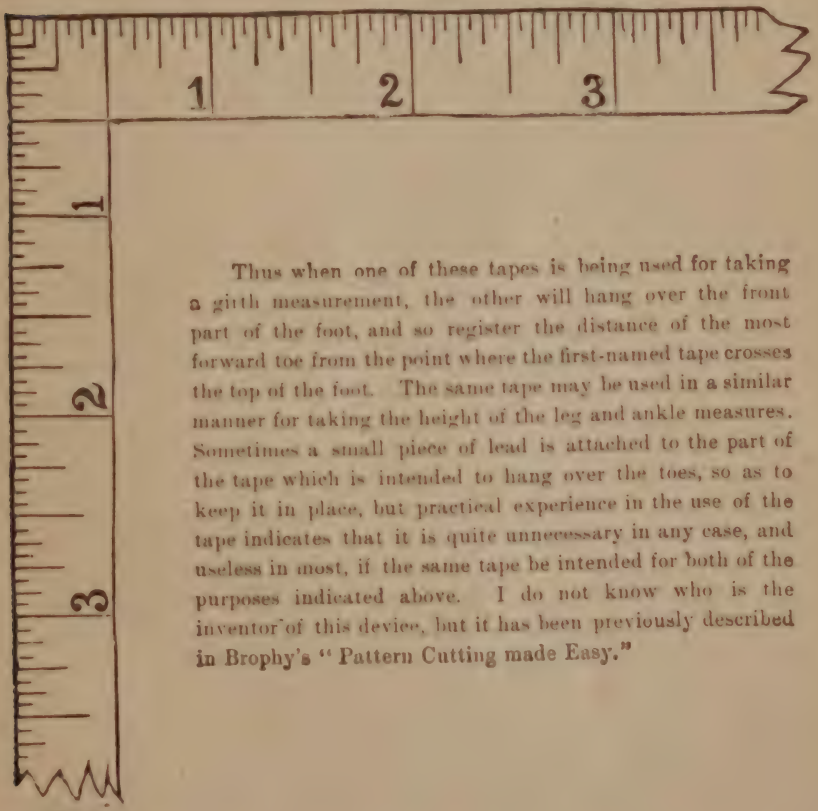

Fig. 6.

Thus when one of these tapes is being used for taking a girth measurement, the other will hang over the front part of the foot, and so register the distance of the most forward toe from the point where the first-named tape crosses the top of the foot. The same tape may be used in a similar manner for taking the height of the leg and ankle measures. Sometimes a small piece of lead is attached to the part of the tape which is intended to hang over the toes, so as to keep it in place, but practical experience in the use of the tape indicates that it is quite unnecessary in any case, and useless in most, if the same tape be intended for both of the purposes indicated above. I do not know who is the inventor of this device, but it has been previously described in Brophy's "Pattern Cutting made Easy."

Heel Measurement. The best position for the foot when taking the heel measurement differs with the kind of boot to be provided. If the boots are to have *low heels*, the foot should be at right angles to the leg, as that is

the relative position the foot will occupy when in the boot: but when *high heels* are wanted, the heel measure should be taken with the toes resting on the ground, and the heel raised somewhat, as the foot will be when the boot is worn. (*See fig. 7*).

Fig. 7.

It will be found that when the heel is raised as described, the heel measure will be from ⅛ in. to ¼in. less than when measured with the foot at right angles to the leg. The reason for this is that the tendons or leaders going from the leg to the toes, over the foot, are more nearly in a straight line, and therefore exert less pressure on the encircling band or annular ligament which holds them down just at the throat of the foot. It is somewhat important to measure the heel carefully, because, for high heels, the upper should clip rather tightly round the foot at that particular part, in order to somewhat counteract the tendency which the weight of the body has to force the foot into the toes of the boot. If this is not attended to, crushed or distorted toes, corns, &c., can only be avoided by giving extra length to the boot. We are not speaking now of those absurdly high heels worn by some ladies, but what we mean by high heels are those that range from 1¼in. to 1¾in. in height. Where the heel is 2 inches or more in height the foot is carried altogether out of its natural position, and its natural action is prevented. In such cases the foot increases in length very little, indeed the boots can be made a size shorter than if they were to carry a heel say from 1¼in. to 1½in. in height.

People wearing excessively high heels cannot, strictly speaking, be said to walk; their mode of progression is something like a person walking on stilts. The strain on the foot is similar to that which would be experienced by a person shod in an ordinary manner continually walking down hill. These high heels may give some little advantage when going up a hill, but they give a corresponding disadvantage when descending one.

Matters requiring Special Attention.

The description given so far is the ordinary method of measuring an ordinary foot, but where great accuracy of fit is demanded, or a special character of foot, or deformity has to be provided for, numerous other points might be, and ought to be attended to, and the chief of these we proceed to describe.

A difference in size of the Feet of the same person is sometimes observed, when, of course, a measurement of both feet should be made, and perhaps a special draft of each foot for this or other reasons, such as corns, &c., be given.

Swelling on the Instep. On drawing the hand down the instep of a foot a distinct abnormal rise is frequently noticed; it may be on one foot and not the other, but in case it is not noticed, and allowed for when fitting up the lasts, the boots may cause considerable pain at that point, especially if a seam comes over it, as it would be likely to in the case of an ordinary elastic sides boot.

The Arch of the Waist varies considerably, some feet being much flatter than others whilst having the same girth measure. If no attention is paid to this an ill-fitting and uncomfortable boot is likely to result. The draft, or impression of the foot, will show these characteristics sufficiently well in nearly all cases, though a profile may be added with advantage in exceptional ones.

Want of Proportion. Should any part of the foot be out of proportion with the rest it should be noted, and the character and position of such abnormality accurately defined.

Types of Feet. Besides variations in shape of the sole, which will be spoken of later on, there are certain other well recognised variations in form, to some of which we now draw attention. Three common types of feet are shown in *figures 8, 9, and 10.*

Fig 8.

Fig. 8 shows a foot in something like what is usually regarded as the normal shape; an ordinary last only would be required for this.

Fig. 9 represents a type of foot also frequently met with; it has a high instep, thick ankle, and small heel measure. The small heel measure can be accounted for in two ways, either by a falling off or thinness at the bottom of the leg, or by there being a smaller projection than usual at the heel, the foot being at the same time very thin along the sides of the heel; generally, however, it is the falling off at the heel. It will, therefore, be readily seen that it depends entirely upon where the falling off is, how we are to fit up the last and cut the uppers. If the thinness is at the bottom of the leg, the pattern must be reduced to the measure at that point, but if at the heel, the upper would have to be cut small at the seat, and a last selected to correspond with the form of the foot, *i.e.* narrow in the seat and thin along the sides of the heel. Were a boot made for this latter kind of foot on a full-seated last the heel would rock about in it, and if the upper were cut exact to measure, it would not meet in the throat.

Fig. 9.

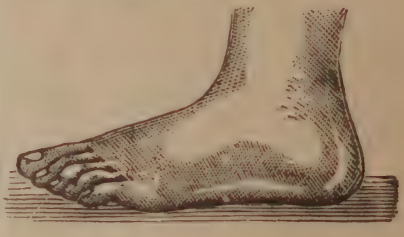

Fig. 10.

Figure 10, as will be seen, represents a foot almost exactly opposite to the last one in the particular points referred to, having a small instep and ankle, and large heel measure, and the method of treatment should be of the character described as unsuitable to the one shown in *fig. 9*.

The Measurer's Duties. Since feet having the same length and girth measurements may be very unlike each other actually, it is clearly the duty of the measurer to supply the last fitter with full instructions respecting the kind of foot, and any peculiarities, or actual deformities, or in some cases to make the necessary allowances himself before sending the measures, as he only is in a position to know all the requirements of the foot to be provided with a covering. He ought to be able to send the *exact figures* representing the *length* and *girth* measurements that the boot should have, and to recognize, and describe in terse language the kind of foot, or the kind of last desirable to employ, and not leave such matters to the manufacturer, who may or may not make the proper allowances, or select the right type of last.

Below we indicate the most important, because most common, considerations that should receive the attention of the measurer and be provided for by him.

The Weight of the Person has something to do with making a suitable boot, as the heavier a man is the more will his feet expand in walking. It It is not usual to weigh a man for his boots, but it is well known that big heavy men cannot, as a rule, bear their boots so tight as light persons can.

Age is another matter requiring attention. Growing feet should have some allowance made for development. Elderly people are sometimes liable to a swelling of the feet, especially towards the end of the day, and if this is not allowed for they may lay considerable blame on the shoes they wear.

It seems to be a fairly well established fact that the feet of girls are often larger between the ages of 16 and 20 than at any subsequent period, the enlargement being due to a somewhat inflamed condition of the foot; the time of commencement of this, of its persistence, and of its subsidence, varying with different individuals.

The feet of men may continue to lengthen up to the age of 32 or 33, sometimes as much as half-an-inch after the age of 30.

The Occupation of the Wearer should not be altogether neglected. Persons who have to lift or carry heavy loads, such as draymen and porters, may require as much allowance in their boots as heavy persons, on account of the extension and expansion of the foot under additional pressure.

Fleshy and Bony Feet require different allowances. A person who has fleshy feet can generally wear smaller boots than one who has bony feet when their feet measure the same in girth. A boot for a bony foot should be made up to measure on the joint, and ⅛in. under instep measure; one for a fleshy foot ⅛in. under at joint and ¼in. under at instep, for ordinary walking boots.

We are not in a position, at present, to classify all feet into a sufficiently small number of types to ensure that the corresponding type of last would be available in even a well equipped warehouse, but overleaf is appended a "*Form of Order*" which, together with the draft of the foot, would give all necessary particulars for the provision of the neatest and most comfortable foot-covering possible under given circumstances.

Order No. 1048. **Date Nov. 15/89.**

Description. Gent's. all calf Derby Bals., leather lined, half bellows tongue, straight plain toe cap, waterproofed, clump soles, hand sewn, 1⅛" heel, wide welts. A strong pair for rough wear. Wide toes.

List of Measurements.

Length of Foot in sizes. Girth in inches.	Length of Foot.	Size made.	Joint.	Instep.	Heel.	Ankle.	Height.	Leg.	Calf.
Right Foot ...	4½	7½	9	9⅝	13¼	9	7	10	—
Left Foot ...	4½	7½	9⅛	9¾	13⅜	9	7	10	—

Seat	*Heel-bone rather prominent.*
Waist	*Moderately arched.*
Toes	*Rather square in front.*
Bunion	
Corns	*One on joint of little toe of each foot (see draft).*
Treading over ...	*Inclined to tread over on the outside. Give last an opposite inclination.*
General Remarks	*Wanted by*.....

Special Methods of Measurement, &c.

1st. It is quite possible to take accurate measurements of the foot without the use of sizestick or tape measure, thus :—The foot is placed upon a piece of paper on the ground, the weight of the body being upon it; two small articles that will stand perpendicularly to the paper, such as a book or box, &c., are placed just touching the heel and toe respectively, and marks are made on the paper on the side of these objects nearest the foot, thus giving the length; at the same time an outline of the foot may be taken.

The girth measurements are taken by means of a strip of paper, a slight tear being made for each measure, the joint, instep, and heel on one edge of the paper, and the ankle and leg on the other. The exact place where the joint and instep measures are taken may be marked upon the draft, so that the last fitter can measure the last in the same place as the foot was measured.

When taking measurements in this way it must not be forgotten that the foot will measure nearly a size larger than it does when raised from the ground as in the ordinary method, so that less allowance is required afterwards, say 2 sizes instead of three.

2nd. Another method of measuring the foot is founded upon the principle that all measures should be taken at a certain distance from the heel. The actual method of carrying out this system is as follows :—The length and outline of the foot are taken in the usual way ; next, one end of the tape is held firmly at a certain point and the other end brought round the back of the heel to a point exactly opposite, keeping the tape horizontal the while, and a girth measurement is made across the two points thus determined. The result may be recorded in some such way as this :—

Measure round foot 14½ *in.*
Joint measure 7¾ *in.*

This would be a good system providing the method of ascertaining these distances could be depended upon, to us this seems very doubtful, as the thickness of the last at the heel and along the sides must modify the actual longitudinal distance measured, and so the position of the girth measurement. There can be no doubt that the system described on pages 10 and 11 is much better.

The Podameter. Another method of measurement is by means of an instrument called a "*Podameter*," two illustrations of which are given *(figures 11 and 12)*. The apparatus is a patent of Mr. S. J. Scott of Glasgow. It consists of a box, one end of which is higher than the other, so that the foot may rest on the upper surface in about the same position that it would occupy when an ordinary measurement is made. The hinder part of the fixed projection from the back of the instrument, which is made to fit exactly round the back of the foot or last, is perfectly level with the commencement of a copy of the sizestick printed upon the surface of the chart. The *chart* is a sheet of paper made to just fit on the top of the instrument ; it slips under two guides at one end, and, when in place, is clamped at the other end. A jointed finger travels along a brass rod on each side of the instrument, and a movable brass support can be used to raise the last just sufficient for the tape to go easily underneath. *(See fig. 12).*

When the tape is carried round the foot or last, one or other of the movable fingers is let fall on its centre, and a mark is made upon the chart at the root of the finger, and the exact measurement at that spot is noted. An outline of the foot is taken on the same chart, the fingers again being used to indicate the exact position, longitudinally, where any malformation or deformity exists. All measurements must be made straight across, or both fingers used.

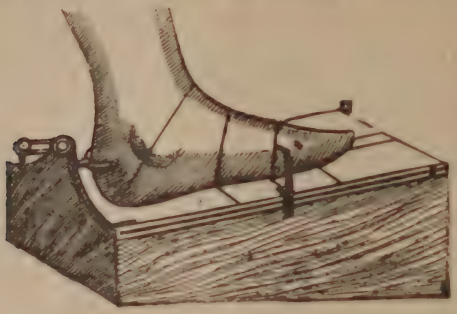

Fig. 11.

Fig. 12.

The advantages claimed for this method of measurement are, that anyone with little or no experience can take a measure of the foot with it, and no matter where the foot is measured the last will be measured in exactly the same place. All the instruments and charts being alike it follows that a manufacturer receiving a chart, and having an instrument, can proceed to fit up the last almost as well as if he had taken the measure himself.

A special pencil is now issued with this instrument, it is made perfectly flat on one side, so that an outline can be taken close up to the foot.

Objections have been made to the Podameter on account of the time taken in fixing the last to the instrument. We think the Podameter would be better without this fixing arrangement than with it, and would suggest

the following method of using the instrument:—Place the chart upon the apparatus, and the last upon the chart, and *mark upon the last itself* the points of measurement indicated by the chart, and proceed to fit it up in the usual manner. This would take very little time indeed, but would insure the last being measured in the same place as the foot.

Another objection raised against the Podameter, and rightly so, is that you cannot with certainty register the length of the foot by simply drawing a pencil mark round it. This defect might be easily remedied by having an upright extending right across the instrument, and movable along the bars in the same manner as the fingers. This upright would be moved forward to meet the most forward part of the foot or last, and so would accurately register the length of the foot or last.

The Pedistat. An instrument devised by Mr. Ellis, and described by him in his book on the Human Foot,* pages 100 to 102, and named a Pedistat, is very useful in studying the formation of various feet. Readers are referred to the original description for further particulars.

Another form of Pedistat which has been found very useful in illustrating some of the foot changes already spoken of, is one constructed by Mr. H. W. Morris, of Northampton. A diagram of this is given in *fig. 13.* It consists of an oblong, box-shaped support, with two uprights—B and C—movable in a horizontal direction along slots let into the upper surface; and a wooden screw that can be raised or lowered, at A. A scale of inches and divisions is fixed on the side of the heel upright, and on the upper surface of the instrument are four scales; the centre one being a copy of the English sizestick, and the others respectively French sizes; English measure in inches; and French measure in centimetres. The heel piece C is usually pushed as far as it will go towards A, so that all alteration in length of the foot must be measured by the toe piece B, but it can be removed if necessary, as for taking the heel measure. The instrument is useful in showing the variation in length of the foot as the weight of the body is put upon it, or the alteration in length as the heel is raised, and the difference in heel measurement with different heights of heel. The Scale at C shows the height the heel is raised. We notice that Messrs. Hill and Yeoman suggest an instrument similar to this in their Manual of Boot and Shoe Manufacture.†

* "The Human Foot," by Thomas S. Ellis. J. & A. Churchill.

† "A Manual of Boot and Shoe Manufacture," by Herbert Hill and Henry Yeoman. Office of Boot and Shoe Trades Journal.

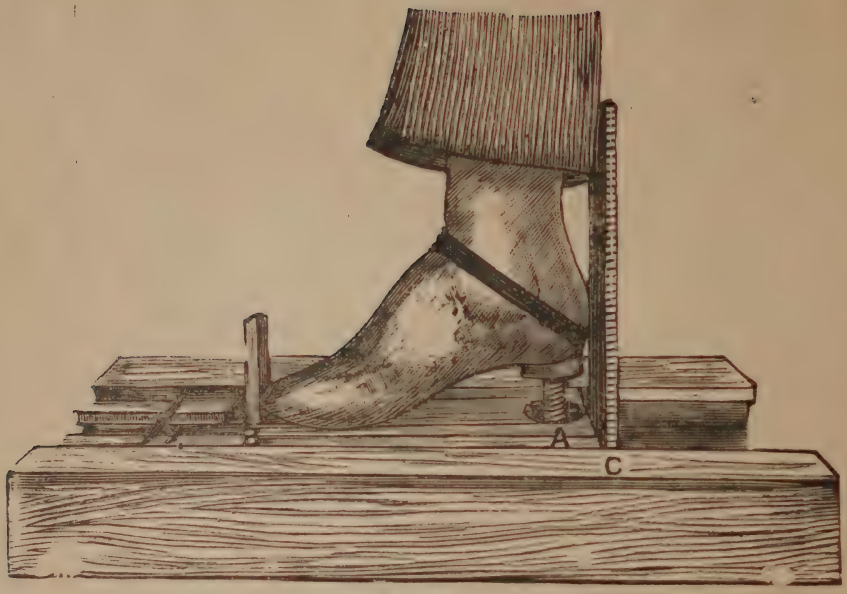

Fig. 13.

Impressions of the Foot. For purposes of investigation, or for ordinary trade purposes, impressions of the feet are sometimes taken ; such impressions, combined with an outline, are very useful in showing the character of the sole, and the positions of chief pressure in a foot bearing the weight of the body. Many methods have been suggested, and more or less successfully applied for getting impressions, but after trying a number of devices at the Northampton Technological Classes, two, apparently not before suggested, have been found most practicable, giving good results with little trouble.

(1). Make a strong solution of one of the aniline dyes (Rosein was used in our experiments) in alcohol, add about an equal bulk of glycerine, and soak some moderately thin white blotting paper in it, and allow to drain. The paper so prepared can be used like ordinary black-leaf ; and by placing it between two sheets of unglazed paper—blotting paper again does well—resting upon a smooth surface, two excellent impressions may be obtained, one on each sheet of white paper. An outline should also be drawn at the same time. The two impressions illustrated in *figures 14 and 15* were taken in this way—*fig. 14* of a flat foot, and *fig. 15* an arched one. I may add that the same prepared sheet will keep in condition for use for a long time, and do for a good number of impressions.

Fig. 14.

Fig. 15.

(2). Make a solution of Iodine in Potassic Iodide, or Alcohol, and moisten the upper surface of a blotting pad with this, then place over it a piece of white blotting paper which has been soaked in starch and dried, or simply rubbed over with dry starch powder. Place the foot on this latter paper, and whilst there draw an outline of the foot with a pencil or other blunt-pointed instrument. On removing the paper a deep blue impression and outline will be found on the starched paper.

Other methods which have been found to give fair results, or even good ones with care, are these :—

(*a*). Aniline dye on glazed paper : impression on moistened paper.

(*b*). Tannic acid one sheet, and ferric chloride the other, a black impression being the result.

(*c*). Cover a piece of card with any light-coloured powder such as chalk, rub it down smooth, and put over this a piece of soft blackened paper the surface of which has been rubbed over with moist soap ; after placing the foot on the latter, a light-coloured impression on a dark ground is produced.

In most of our experiments ordinary white filtering was used.

No doubt excellent impressions may be obtained by the method described by Mr. Ellis* of covering the sole of the foot with printers ink and then standing on white paper, but I do not think they are superior to those obtained by the first of the methods explained above, and it is, moreover, a method which could scarcely be used for trade purposes.

Wet paper, or papier maché are sometimes used for taking impressions,

* "The Human Foot," by Thomas S. Ellis.

LAST FITTING.

Much care and attention has been given to the shapes of lasts of recent years, with the result that there is an undoubted improvement in general suitability for ordinary feet, still, to meet the necessities of abnormal feet various devices have to be resorted to, the chief of which are detailed below.

Fittings are pieces of *gutta-percha* or *leather* affixed to lasts for the purpose of increasing the measurement at any part. They are usually made of leather, and are first cut of such a shape as to best fit the part of the last to which they are to be attached; they are then *skived* thin all round the edges, so that no abrupt change of thickness may occur, and afterwards damped, and blocked into position on the last. When dry they are ready for use, and may be affixed to wooden lasts by small tingles. Of course cement must be used for iron lasts in the case of leather fittings not on the blocks, but for gutta-percha the last and inner surface of the gutta-percha should be heated in some smokeless flame and then pressed together with wet fingers. Lasts having iron blocks sometimes have holes made in them, which are plugged with lead or leather, similar to those made in the bottoms of iron lasts for attaching the insole. These plugs of soft material serve for the attachment of fittings to the block.

The fittings should be made in two different substances of material so as to give ¼in. or ⅛in. difference to the measurement, and of course must be of different sizes to suit different sizes of lasts, though it is scarcely necessary to have separate fittings for every size.

The shaded portions of the drawings in *figures 16, 17, 18, 19, and 20,* show the principal fittings used.

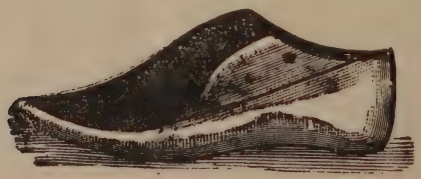

Fig 16.

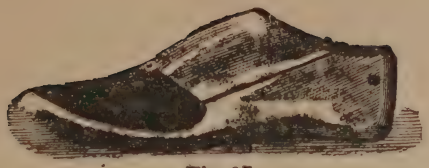

Fig 17.

The Joint and Instep fitting, fig. 16, is used to increase the measurement of both joint and instep—this is sometimes called a *shover*.

Joint fitting, fig. 17, to increase the joint measurement only.

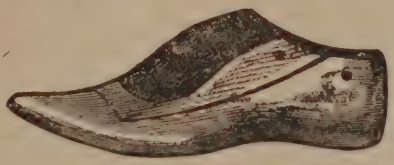

Fig. 18.

Instep fitting, fig. 18, to increase the instep measurement only.

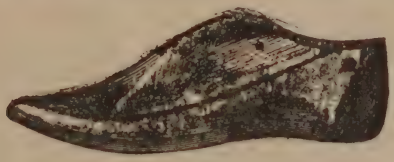

Fig. 19.

The Heel Pin, fig. 19, is sometimes used to lengthen the last. We do not recommend the use of this fitting if it can be avoided, as it increases the length of the heel, and throws the instep forward, but in some cases it is advisable to use it. It can be used to advantage, for instance, when the last is required a little longer and there is a large heel measure; for a small heel measure it certainly should not be used, but a toe piece instead

Fig. 20.

Fig 20 shows how the last may be increased in width at the joints or toes

Other fittings such as *bunion pieces, waist pieces,* pieces for *corns, raised toes, in-growing nails, &c.*, may also be used. The waist pieces are used to fill up the waist of the last for flat-footed people. Of course all these fittings can be used separately or in combination, care being taken always to prevent sudden changes of thickness, and to preserve, as nearly as possible, the general contour of the last, or the result may be an uncomfortable or unsightly boot.

Sew-round Lasts. In making provision for bunions or other deformities of any kind on a sew-round last, the fittings must be placed on the opposite last to that representing the foot on which the deformity exists, because the right foot shoe is lasted on the left foot last, and vice versa, the shoes being, at first, lasted inside out. When the shoes are turned and second-lasted, the fittings must be changed, and placed upon the last representing the foot on which the deformity occurs.

For all kinds of turned shoe the last should be a *little smaller* than for a welted boot (we are speaking now of boots and shoes made to measure), because the shoe is lasted in the first instance over the sole, and when the shoe is turned the sole is outside, and so leaves more room inside. The difference between the last for a welted boot and a turn-shoe naturally varies with the substance of the sole in the latter. An allowance of from ⅛ to ¼ inch is generally sufficient.

Foot Deformities. The drawing, *fig. 21*, gives the form of the sole of an ordinary foot in its natural condition. It will be seen that the great toe lies in a direction parallel to a line drawn through the centre of the foot. It is, however, impossible for the great toe to lie in this position if the boots worn are too short, or if they have very narrow toes, unless, in the latter case, additional length is allowed, so that the narrowing of the sole does not commence on the inside of the boot until the anterior ball of the big toe is passed.

Fig. 22.

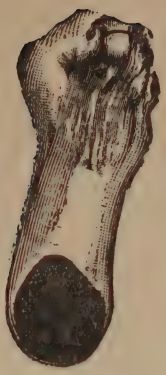

Fig. 23.

Figures 22 and 23 show some of the deformities induced by wearing ill-fitting boots. The drawings are from Nature, and were produced in "The Boot and Shoe Trades Journal" to illustrate the report of a lecture by Professor Flower on "Human deformities produced through fashion or custom." Fig. 22 represents the foot of a working man, and fig. 23 that of a woman, both patients at a London Hospital. Professor Flower said in reference to them :—"The loss of elasticity and motion in the joints of the Foot, as well as the wrong direction acquired by the great toe, are not mere theoretical evils, but are seriously detrimental to free and easy progression, and can only be compensated for in walking by a great expenditure of muscular power in other parts of the body, applied in a disadvantageous manner, and consequently productive of general weariness." In reference to *high heels* the same authority says :—"Only one thing is needed to aggravate the evil effect of a pointed toe, and this is the absurdly high and narrow heels so often seen now on ladies' boots, which throw the whole foot in an unnatural position in walking, produce diseases well known to all surgeons in large practice, and makes the nearest approach yet effected by any European nation to the Chinese custom which we generally speak of with surprise and reprobation."

The distorted condition of the feet shown in *figures 22 and 23* could not have been brought about all at once, and must have been chiefly induced when the persons were young, for were the foot once fully and normally formed the after production of such contortions would be too painful to be readily submitted to. The point we wish to insist on here is that the boots for young people should be made large enough, and long enough, and of the right form, so that there may be no exceptional pressure at any point, and, what is almost equally important, no looseness through the boot being too large.

Allowances. In making up a boot certain allowances have to be made over or under the actual measurement, for a variety of reasons, the chief of which will be indicated further on. The figures given immediately below must only be regarded as a guide to those who have had little experience in the matter; they will often require modifying, and the modifications ought to be made, or suggested, by the person who takes the measure, as previously pointed out.

Table showing the average Allowances for various Boots.

Boots.	Sizes.	Length.	Joint.	Instep.
Children's ...	7 to 10	2 sizes longer	$\frac{1}{8}$" larger	$\frac{1}{4}$" larger
Girls' ...	11 to 1	2 sizes longer	$\frac{1}{8}$" larger	$\frac{1}{8}$" larger
Women's ...	2 to 8	$2\frac{1}{2}$ sizes longer	$\frac{1}{8}$" less	$\frac{1}{4}$" less
Boys' ...	11 to 1	$2\frac{1}{2}$ sizes longer	$\frac{1}{8}$" larger	$\frac{1}{8}$" larger
Youths' ...	2 to 5	3 sizes longer	$\frac{1}{8}$" larger	$\frac{1}{8}$" larger
Men's ...	5 to 11	3 sizes longer	$\frac{1}{8}$" less	$\frac{1}{4}$" less

American lasts are made from $\frac{1}{2}$ size to 2 sizes longer than English lasts because of the shape of the toe, and this would have to be considered in making allowances. Some American boots called 7^s measure 9^s on the English sizestick. Of course where the boots are made so much longer than the foot the toes must be made very hard, that is be well "boxed," or they will turn up with wear and look unsightly. There are indications that this practice of making the boots so much longer than the foot is going out.

Why Allowances are made. Boots are made longer than the foot (1) *to allow for the lengthening of the foot under pressure*, and (2) *to protect the toes from injury*, as it is evident that if the toes came tight up to the end of the boot they would suffer more or less every time the toe of the boot came into contact with anything very resisting. *Figures 24 and 25*, after drawings by Mr. H. W. Morris, are intended to show the relation that should exist between the length of the foot and boot—*fig. 24* when the foot is not resting on the ground, and *fig. 25* when the weight of the body is borne by the foot.

Figure 24. Figure 25.

The allowances suggested in the foregoing table assume that the foot was measured when the toes were raised from the ground. Of course if the foot were measured on the ground, with the weight of the body upon it, it would actually measure more, and so the allowances would be correspondingly less. Some illustrations of this are given below, being the results of carefully conducted experiments for the purpose.

CHILD'S FOOT (4½ years).

In repose.		*Weight of Body upon it.*	
Length	6⅝ sizes	Length ...	7½ sizes
Joint	5¾ inches	Joint	6 inches
Instep	6⅛ ,,	Instep	6⅝ ,,
Heel (raised) ...	8⅝ ,,	Heel	8½ ,,
Width of Sole ...	2⅛ ,,	Width of Sole ...	$2\frac{7}{16}$,,

LADY'S FOOT.

Length	3½ sizes	Length ...	4½ sizes
Joint	8¼ inches	Joint	8½ inches
Instep	8⅝ ,,	Instep	8⅞ ,,
Heel (raised 1½in.) ...	12½ ,,	Heel	12¾ ,,
Width of Sole ...	3⅛ ,,	Width of Sole ...	3⅜ ,,

GENTLEMAN'S FOOT.

In repose.		*Weight of Body upon it.*	
Length	6⅔ sizes	Length ...	7⅔ sizes
Joint ...	8⅝ inches	Joint ...	9 inches
Instep	9½ ,,	Instep	9⅞ ,,
Heel (raised 1¼in.) ...	13 ,,	Heel	13⅜ ,,
Width of Sole ...	3½ ,,	Width of Sole ...	3¾ ,,

Boots for fully developed feet, men's and women's, are made smaller than the foot in girth when the uppers are cut from soft yielding material, to allow for the stretching of such material in wear.

Children's boots are made larger than the foot in girth, to allow for growth, unless the material is very light and pliable.

Boys' and Girls' boots can be made exact to measure at joint and instep when the material is light, but for all strong out-door boots the full allowances named should be made.

If narrow toes are required an additional half size, at least, must be added to the length.

The substance of the upper should determine some of the allowances, in the manner already indicated. Stout uppers, such as grain and stout kip, require the last to be fully as large as the foot at the joint, and very little under at the instep, as such materials will not readily adapt themselves to the feet.

Longitudinal expansion is greater in long, high-arched, slender feet than in short, low-arched, thick ones.

Lateral expansion is greatest in broad, high arched feet, and least in low-arched, narrow ones, as pointed out by Dowie. *

Selection of Proper Lasts. The last fitter must use considerable care and judgment in selecting the last most suited to the foot, before he proceeds to fit it up. Not merely the measurements, but the shape of the sole of the foot, as indicated by the draft or impression of the foot, must be carefully considered. A reference to the feet and sole shapes, *figures 26 and 27*, will show what is meant. *Figures 24 and 25* show the ordinary *straight type of foot*, for which an ordinary last would do. *Fig. 26* shows *a more twisted form*, which the so-called "*anatomical last*" would best suit. *Fig. 27* shows a form of foot where the *toes taper off* very much from the big toe, and the sole shape suited to it.

* "The Foot and its Covering," by James Dowie. Robert HArdwick.

Figure 26.

Figure 27.

In some feet the smaller toes come so far forward that the tips of all the toes are almost in a line, and a reference to the figures will show how very unsuitable a narrow-toed boot would be for such a foot; unless the boot were made much longer than the foot the toes would be all huddled together, producing pain and ultimate deformation.

The Arch of the Waist in the last should conform as nearly as possible to the arch of the foot.

Flat-footed people can generally be suited by making their boots on shoe lasts, as these latter are flatter in the waist than boot lasts.

Height of Heel. To ascertain the height of heel a last will carry, place the last as in *figures 28 and 29*, with the ball resting on the sizestick, or on the bench, and the seat of the last parallel to the latter; the distance A B, with the substance of the sole added, will give the height of heel the particular last is suitable for, except in the case of a very high heel, when it is necessary to have a gradual slope from the seat to the waist.

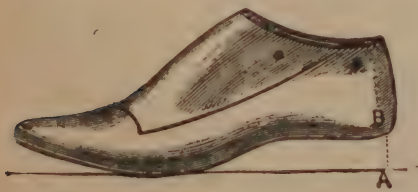

Figure 28.

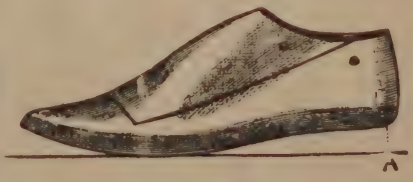

Figure 29.

Use of the Draft. A word of caution in regard to the use of the draft is necessary. When placing a last on a draft to ascertain if it is the right shape, &c., the last should not cover it, but the pencilled outline should be seen at the sides of the last at a distance of from ¼ to ½ inch. This is because of the thickness of the pencil generally used in marking round the foot, which must lead to a larger outline being made than the foot actually has.

Pitch and Spring. By *pitch* is meant the elevation of the seat of a last above the ball of the great toe when the seat is parallel to the horizontal plane on which the ball of the toe rests. By *spring* is meant the elevation of the toe above the same point, under the same conditions. *See figures 28 and 29.* The amount of pitch given to a last is regulated by the height of heel it is intended to carry.

The amount of Spring in the toe of a last should be regulated by the kind of boot required, and the rigidity of its sole; very often it is merely a question of the appearance of the finished article. For boots with light soles very little spring is needed, as the sole will bend with the foot in walking, and not leave permanent wrinkles across the joints. In the case of stout boots with thick soles much more spring should be given, for if not, the necessary amount will be gradually developed in the boot, with the complement of permanent wrinkles across the upper, which may become a considerable inconvenience to the wearer. It is scarcely business-like to expect a customer to finish the shaping of his shoes under disadvantageous circumstances, such as, no doubt, most of us at some time or other have experienced when walking, or going up or down stairs with boots having new, rigid soles, and too little spring. People can get used to flat soles, but a loss of elasticity in the step results; this is very evident in the case of the agricultural labourer as a class. For the reasons given above the clogs, or shoes with wooden soles, worn in some of our northern towns, have a great deal of spring given to them, indeed they are almost like boats in appearance.

Boot and Shoe Lasts. The difference between boot and shoe lasts consists in the latter, the shoe last, being flatter in the waist, thinner along the sides, and having more wood along the outside of the waist than the boot last. *See figures 28 and 29.* There is no doubt that a shoe last conforms more nearly to the actual form of the foot than does a boot last, and this, of late, has been more generally recognized by the trade, manufacturers using lasts to make boots upon that are also suitable for shoes. We cannot see why this should not be done generally, for the nearer the last is made to correspond with the form of the foot the more comfortable will be the boot or shoe made upon it. Generally speaking, the ordinary boot

last is too arched in the waist; in wear this arch is broken down by the weight of the body, and the boots wrinkle all along the quarters below the ankle, from the heel to the vamps. This, besides detracting from the appearance of the boots, causes them to wear out quicker.

Slipper Lasts are usually made with more spring in the toes than shoe lasts, and flatter still in the waist. They are made thus with the idea that when the foot is put into the slipper it will force the toe down, and so pull the quarters close along the sides of the foot.

Some people contend that an excessive amount of spring in the toe is a mistake, as the slipper then has a tendency to curl up at the toe, whereas a sufficient amount of clip is procured if the last is made thin along the sides of the quarters. It is only necessary to add, in reference to this difference of opinion, that if the spring commences before the ball of the big toe is passed, the supposed defect of the first of these methods of treatment will be obviated.

Court and Dress Shoes are made with a good amount of spring, for reasons fully described in the two preceeding sections.

Running over in Boots. Sometimes we see boots running over considerably on one side; this may be the fault of the boot, or of the person wearing it, or both. So far as the person is concerned it may be due to some peculiarity in walking, either natural through some malformation of the foot itself, or from habit; an unnatural habit of walking sometimes being brought about from painful corns or bunions, the foot not being placed flat on the ground as it ought to be. No doubt most people who find their boots running over are more ready to blame the boots than themselves, and certainly it is the shoemaker's business to remedy it as far as possible, from whatever cause due. The defects in boots which may give rise to it are:—(1) bottoms being too narrow; (2) the heel being high and too narrow at the top, *i.e.* the top pieces too small, whereby the heel runs over; (3) the heels not being pitched properly; (4) the seat of the last being too large, so that the foot rocks about and eventually goes over; or (5) the stiffeners may be to blame, being too soft and poor, or skived too thin, or not properly lasted in.

Running over may be corrected or prevented to a large extent by one or more of the following methods, depending upon the cause:—by using a last wider in the sole, and particularly at the point where running over occurs, but it should only be wide enough to permit of the free action of the foot. The most approved method is to fit a last so as to make it slightly round on the side opposite to that on which the running over occurs, so that the boot

will give to the foot a contrary inclination when worn. If the running over occurs at the heel, the defect of structure which causes it should be remedied by such devices as making it squarer, not so high, not too far forward, or perhaps a little longer on the side where the fall takes place.

Special Deformities.

Under this head it is proposed to consider only such deformities or malformations of the foot as the shoemanufacturer is often called upon to provide for, or to help in correcting. Strictly speaking a distinction ought to be made between malformations and deformities, - the former existing at birth the latter being brought about afterwards by accident, carlessness on the part of young people or their parents, or, unfortunately too often, by ill-fitting shoes. As no such distinction in terms seems to be recognized in the trade, we have grouped all abnormal structures under the head of deformities, the more readily that some of the defects, flat-foot for instance, may be either malformations or deformities.

Speaking generally, we should recommend that the boots for *young persons*, even though there be some small deformity, be made as nearly as possible, consistent with ease, upon lasts that would suit the normal foot, as by this means the deformity may be somewhat corrected. For *elderly persons* this is not desirable, as it would almost certainly give pain, without the solace of probable recovery. For these people we often have to depart considerably from that form of last which is supposed to be best for an ordinary foot.

Wherever there is any great peculiarity in the foot, lasts should be specially made.

Raised Toes are chiefly brought about by the wearing of narrow-toed or short boots, hence by making the boots wider at the toes, and of greater length, so that the toes of the foot may spread out naturally, they may regain somewhat their proper position, a method which is preferable to simply giving the toes more room vertically by means of fittings.

Bunions. Since the treatmeut of a bunion is intimately connected with its cause, a few words on the cause of bunions seem to appropriately come here. As with raised toes, so with bunions, narrow-toed or short boots are chiefly responsible. The big toe in either case being compelled to take an unnatural position, it follows that the end surfaces of the bones opposed to each ether, viz., the metatarsal bone and first bone of the big toe, which ought to be somewhat parallel, meet at an angle, with partial dislocation of the joint, and thus form a more or less triangular space, which allows the synovial membranes covering the ends of the bones to expand with the

increased synovial secretion consequent on the inflammation produced at the point of greater pressure. The swelling thus produced is very painful, and, if not attended to early may become a tolerably permanent source of pain or inconvenience, and sometimes even necessitate amputation of the toe.

The treatment of bunions by the shoemaker alone requires our attention, and here there is considerable diversity of opinion. Some advocate treating the foot as though no bunion existed, and assert that if the last is fitted up to measure, the fittings being distributed all across the top of the last, and the bottom of the last left as for a natural foot, the necessary relief will be given, and the enlarged joint ultimately disappear. In cases where the bunion is only just forming the above treatment would probably be successful, though scarcely without pain.

For a full-grown bunion of long standing this would not do. By putting the hand into boots that have been worn for a time by persons having abnormal projections of any kind on their feet, it may always be noticed that such projections have made for themselves hollows, and this is particularly the case when there has been an enlarged toe joint. It seems, therefore, much better to provide these hollows in the new boots, rather than inflict unnecessary punishment upon the possessor of the deformity until the boot has got bedded to the foot, which we certainly should do if we provided the customer with an ordinary flat insole. It must be distinctly understood that we do not recommend the piling of leather on the sole of the last so as to provide a cavity large enough to bury the joint, but one only just deep enough to prevent painful pressure, with a very gentle inclination into it, so that the sliding of the foot backwards and forwards in the boot may not bring about longitudinal pressure. The remainder of the necessary fitting should be placed on the top of the last just over the bunion; always taking care that there is sufficient width and length for the toes to lie flat, and take their normal position; and that the last, when fitted up, shall measure fully as much as the foot at the joint over the bunion. Such a method of treatment we have found gives the necessary ease, and the boots can be worn with comfort even the first time of putting them on.

Flat Foot is caused by the arch of the foot giving way, whence a general flattening of the sole results. The method of fitting a last for such a foot has already been given, but this was not remedial in character. An apparatus may, however, be used which will greatly help to restore the foot to its natural condition.*

* See "The Human Foot in Health and Disease," by J. Rhys, M.R.C.S., Eng., L.S.A., Lond., pages 31 and 35.

The apparatus, of which a drawing is given (*see fig. 30*), is called a "Valgus pad;" it can be fitted into the boot like a sock, and may be used

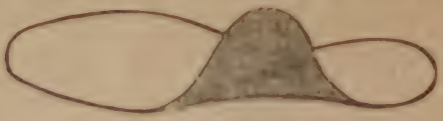

Figure 30.

in all cases where the arch of the foot has a tendency to fall and the foot to turn inwards. The pad consists of a steel spring enclosed between two layers of leather, which latter are stitched all round the edge. There is a pad of India rubber, felt, or cork placed between the upper layer of leather and the spring, just under the arch of the foot. The convexity of the spring will, of course, depend upon the condition of the foot, and it is fixed at the back by a single rivet on to the insole, the anterior part being left free, to allow for lengthening as the pressure of the foot is brought on to it.

Weak Ankle. Much difference of opinion exists, not only amongst makers of shoes, but apparently also in the medical profession, as to how weak ankles should be treated. Some assert that to strengthen the ankle stays and bandages should be used; others would do away with both, and recommend the wearing of nothing but low shoes. Perhaps the causes of weak ankle are sufficiently numerous for both to be right according to circumstances. We shall not attempt to discuss the method of treatment, but merely say that we have used high stiffeners of leather up the sides of the ankles with very satisfactory results. These stiffeners must, it is scarcely necessary to say, be properly fitted and put in. The drawing (*fig. 31*) will show the position and character of the stiffener used.

Figure 31.

An appliance which has some good points in it is "**Bartlett's Patent Surgical Ankle Support**." The appliance is made from bottom

leather, and is cut the shape of the sole of the last, except on one side, where a piece is left on to come up the side of the foot. The leather is blocked so as to conform to the inside of the boot and a steel spring is attached to the part which supports the ankle. The whole apparatus is neatly covered with chamois leather and roan, and is perfectly smooth and sufficiently pliable.

In cases where a *Valgus pad* or *ankle support* is used, it is necessary to fit the last up large enough to admit both this and the foot; the exact amount of allowance can be ascertained by placing the pad or support on the last and finding the difference between the measure then and the measure of the bare last.

Club Foot. The technical name by which this species of deformity is known is *talipes*, and, so far as the shoemaker is concerned, the provision for it is usually a proper adaptation of cork to some portion of the sole. The simplest case in which cork is required is that of *short leg*, without particular deformity of the foot, in which case the cork will be added to a boot made on an ordinary last.

In cases where there is distinct deformity of the foot itself, whether accompanied by short leg or not, a special last is required. The provision of boots for cripples is almost a special branch of the trade, as nearly every case presents some difference, and, moreover, is often carried out under the instructions of a surgeon; it will not be necessary here to do more than describe one of the most common forms, the principles being the same in all. Take the case of *talipes equinus*, so called because the toes only touch the ground, as in the case of the horse. Here, of course, it is necessary to provide a support for the heel, and this is done by affixing to the seat of the shoe a piece of cork, properly shaped, and covered with leather, so that it will give the requisite support to the heel. Cork may likewise be inserted in the sole of the boot, if necessary, to give support to the hinder part of the sole of the foot, or for appearance. Considerable care is necessary to ensure that the heel support is not too high or it will tend to force the foot forward and cause the toes still to bear the weight of the body throughout each step; the heel of the boot may even be a trifle shorter than the space it is supposed to fill, so that the heel itself will fall a little. The club foot of this kind is, of course, shorter than the sound foot, and so, for the sake of appearance, the boot for it is sometimes made longer than the foot; this can scarcely be recommended as it adds to the difficulty of walking.

We selected this particular form of club foot to speak of partly because it is one of the commonest, and partly that we might notice, in connection with it, a very ingenious device of Mr. J. Rhys, and described in his work on the Foot.* It consists in treating the sound leg as a short one, for the simple reason that the deformed one acts as though too long. To verify this statement it is only necessary to imitate talipes equinus by raising the heel of one foot some two inches on to a block, whilst the other rests on the ground, when it will be observed that the first leg can only be straightened by raising the heel of the second foot in like manner, or the whole foot about one inch. Mr. Rhys' method, then, consists in placing a pad under the sole of the sound foot, of such a thickness as to allow of the straightening of the other leg. The principle is illustrated by the two drawings *(figures 32 and 33)*, where the dark shaded portion represents the cork. The advantages rightly claimed for this are :—that the straightening of the leg will give healthy exercise to the knee joint ; will enable the patient to walk better ; and transmit the pressure of the body more directly on to the heel.

Figure 32.

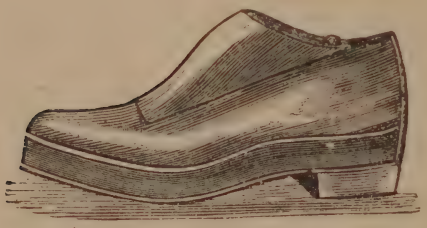

Figure 33.

Conclusion. Supposing the measurer and last fitter have done all that is necessary to insure, on their part, a good result, it by no means follows that such good result will be insured ; the cutters of uppers must be equally careful. It would, for instance, be of little use for a last fitter to provide

* "The Human Foot in Health and Disease," by J. Rhys, M.R.C.S. Eng., L.S.A., London.

for a bunion if the upper were cut so that a seam came right across it. Often the *clicking* and *last-fitting* are done by the same person; in such case the upper would generally be cut properly, but where different people do these respectively, the pattern cutter must be a thoroughly practical man, and one who can understand by the measurements and description the exact character of the foot he is providing for.

Although it has been our endeavour to give all desirable information on the subjects of Measurement and Last Fitting, we hope that the matter has been so arranged that the simple necessary instructions are prominently brought out.

APPENDIX.

Standard Measurements.

In the earlier part of this Handbook (page 6) the defects and irregularities of the ordinary sizestick were referred to. The irregularities might soon be eliminated if each purchaser of a sizestick were to carefully test it with an English inch measure, and to refuse all not quite accurate. To correct the defects of the sizestick is a much more serious business. Numerous writers in our Trade Journals have pointed out the defects of the present sizestick, and have suggested alterations. Some of these alterations would no doubt be improvements. The substitution of the ordinary inch measure for the present arbitrary sizes, so that the customer, as well as the shoemaker, might have an intelligent idea of the size of his foot and the boot required to cover it properly, has met with considerable favour with those who hope to bring about a system of *genuine standard measures.*

The system of measuring the foot and lasts by the inch, as well in length as in girth, has met with sufficient favour to induce Mr. Mahaffy, of London, to apply for a patent for a sizestick which shall embody the principle of inch measurement instead of sizes (though the old sizes would be on the stick), together with a special innovation in the matter of making four sizes to the inch instead of three. According to this system, if a person's foot measured 10 inches it would not be called a 5^{s}, as at present, but a 10^{s}, and the sizes would then run 10, 10½, 10¾, 11, which latter would correspond to the 8^{s} at present in use.

I certainly think Mr. Mahaffy's system is a very good one, and worthy the attention of the trade, *providing that the four sizes to the inch does not*

complicate the scale of girth measurements, but on this point we are awaiting information.

Sometime ago I thought of bringing before the notice of the trade a scale which, whilst meeting all the well-recognised difficulties accompanying the use of the old sizestick, would admit of a continuous graduated scale of girth measures. My only reason for not publishing it being that it would entail such a radical change, that few, if any, manufacturers would entertain it. However, as this question of Standard Measurements appears to have excited considerable attention, and rightly so, I venture to submit the scale to my readers.

Comparison of Sizesticks. In *fig. 34* opposite this page, we give five scales, illustrating respectively three of those now in use and two suggested new ones :—

		Length of a Size.
1.	English sizestick at present in use	$\frac{1}{3}$ inch.
2.	Suggested new sizestick	$\frac{2}{9}$,,
3.	English inch measure, which shows sufficiently well Mr. Mahaffy's proposed new sizestick ...	$\frac{1}{4}$,,
4.	French sizestick ... ... about	$\frac{4}{15}$,,
5.	American sizestick, $\frac{1}{12}$ inch shorter than the English sizestick	$\frac{1}{3}$,,

Explanation of New Sizestick and Scales. It is generally admitted that 3 sizes to the inch is too small a number, and that 6, or half sizes, is too many. Scale No. 2 is partly designed to meet this difficulty, as it would give 9 sizes to two inches, a number just intermediate between 6 sizes or 12 half-sizes by the old method. The adoption of this would render half-sizes wholly unnecessary. The scale commences at the same point as the old one, that is at $4\frac{1}{3}$ inches from the end, but no break is made.

The sizes could be classified as below :—

Infants' ...	1 to 9	Boys' ...	10 to 21
Little Girls' ...	10 to 15	Youths' ...	22 to 27
Girls' ...	16 to 21	Men's ...	28 to 36
Women's ...	22 to 30		

Girth Measurements. Equally important with the provision of a suitable number of sizes for all practical purposes, is the provision of a continuous graduated scale of girth measures through all the sizes, as far as possible. Though such a continuous scale is desirable, and even possible for all the girth measurements, I think it better to make breaks in the continuity in the case of the instep measures, because in the foot itself there

FIG. 84.

is undoubtedly a greater increase in the rise from joint to instep as the sizes get larger, *i.e.* from infancy to maturity.

Below we give a portion of the proposed scale which will well illustrate all the points that have been or are to be referred to in connection with it.

Size.	Joint.	Instep.	Heel.	Ankle.
31	9	$9\frac{6}{14}$	13	9
30	$8\frac{6}{7}$	$9\frac{4}{14}$	$12\frac{11}{14}$	$8\frac{6}{7}$
29	$8\frac{5}{7}$	$9\frac{2}{14}$	$12\frac{8}{14}$	$8\frac{5}{7}$
28	$8\frac{4}{7}$	9	$12\frac{5}{14}$	$8\frac{4}{7}$
27	$8\frac{3}{7}$	$8\frac{11}{14}$	$12\frac{2}{14}$	$8\frac{3}{7}$
26	$8\frac{2}{7}$	$8\frac{9}{14}$	$11\frac{13}{14}$	$8\frac{2}{7}$
25	$8\frac{1}{7}$	$8\frac{7}{14}$	$11\frac{10}{14}$	$8\frac{1}{7}$

This scale may be continued up or down continuously with three of the measurements and nearly so with the fourth, thus :—

Difference between the sizes at joint $\frac{1}{7}$ inch throughout the scale.

" " instep $\frac{1}{7}$ " " (except at breaks).

" " heel $\frac{3}{14}$ " "

" " ankle $\frac{1}{7}$ " "

In the case of the instep measure, breaks in continuity to be made between sizes 9 and 10, 15 and 16, 21 and 22, 27 and 28 ; thus the rise from joint to instep would be as below :—

Men's rise from joint to instep $\frac{6}{14}$ inch.

Youths' " $\frac{5}{14}$ "

Boys' " $\frac{4}{14}$ "

Little Boys' " $\frac{3}{14}$ "

Infants' " $\frac{2}{14}$ "

Of course if anyone prefers to give the men's only $\frac{5}{14}$ inch rise the remainder can each be diminished by a like amount, viz. $\frac{1}{14}$ inch.

The Fittings under this new method would be 1 to 9, which would about equal the present 1 to 6 fittings, the 5 fitting being the equivalent of the present 3 or medium fitting.

EXAMPLE.

Old Joint Measures 8s size ...	1.	2.	3.	4.	5.	6	fittings.
	8½.	8¾.	9.	9¼.	9½.	9¾	inches.

New Joint Measures 31s size	1.	2.	3.	4.	5.	6.	7.	8.	9	fittings.
	8⅛.	8¼.	8⅜.	8½.	9.	9⅛.	9¼.	9⅜.	9½	inches.

In the application of this principle it would be necessary to have a tape divided into 7ths and 14ths.

It will be noticed by those carefully studying the table that the children's sizes will be slightly larger in girth than those at present in use, but this is rather an advantage, for by giving ⅛ inch between the sizes we can carry them right down from men's to children's, without a break at joint, heel, and ankle, and at the same time give slightly more room to allow for the proper development of the foot in children.

I had prepared a continuous scale for the instep measurements, thus :— Taking $\frac{7}{7}$ inch as a suitable rise for the largest men's size, No. 36 ; and $\frac{1}{7}$ for the smallest infants', No. 1 ; then clearly for thirty-six sizes $\frac{1}{35}$ of $\frac{7}{7} = \frac{5}{245}$ will require adding on to each size, in addition to the $\frac{1}{7}$ inch, as we ascend the scale. So that $\frac{1}{7} + \frac{7}{245} = \frac{42}{245}$ inch will be the proper allowance from size to size throughout the scale. An arithmetical progression involving such a fraction I knew would not find favour, and although a special tape might be easily constructed with the proper instep measure for each size marked upon it, I think most people would prefer a method involving the use of one tape only ; hence the introduction of breaks in the continuity of the instep measures.

I know there are two very important considerations which must not be lost sight of when discussing the question of New Standards, the first concerns the manufacturer, and the second the retailer. A manufacturer could not adopt a new standard of measurement without an entire change of plant, which would mean, in many cases, an enormous outlay. A retailer would require a larger stock where more sizes and fittings might be demanded by his customers, and would consequently require a much larger capital to carry on his business successfully.

Notwithstanding the serious drawbacks mentioned, I believe it would be beneficial to the trade generally if some fixed standard of measurements were adopted, so that customers ordering a certain boot of a certain fitting could rely upon getting it. Manufacturers and Retailers would be saved much of the trouble connected with bespoke work.

Such changes as are here suggested cannot be brought about all at once, it would be unreasonable to ask a large manufacturer to throw on one side a valuable plant of knives, lasts, and patterns; but I think it might be brought about gradually, as new plant was required. The whole question is worth the consideration of anyone starting in the shoemaking business, because if he were to adopt the scale here proposed, or a similar one, he would certainly stand a better chance of being able to meet the requirements of his customer

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